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REMARKS ON THE PAPER OF M. D. C. WHITTLEY (PAPER NO.13) "SOME ASPECTS OF PROPULSION FOR THE AUGMENTOR WING CONCEPT"

M. H. Schmitt

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Translation of "Suite à la communication de M. D. C. Whittley (Paper n° 13) "Some aspects of Propulsion for the Augmentor Wing Concept", Sté Bertin et cie, Plaiser, France, Paper for presentation at the AGARD Propulsion and Energetics Panel, 38th Meeting, "Inlet and Nozzles for Aerospace Engines, Sept. 1971, pp. 1-8.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546 OCTOBER 1971

REMARKS ON THE PAPER OF M. D. C. WHITTLEY (PAPER NO. 13) "SOME ASPECTS OF PROPULSION FOR THE AUGMENTOR WING CONCEPT"

M. H. Schmitt[1]

ABSTRACT. A summary of the work carried out in Europe on dilution systems is given which fall into the category of the propulsive wing. The first application was the aircraft ARADO 232 in Germany in 1943. After that, the ONERA in France took on the development of a combined suction and blowing system, beginning with its inception in 1945. Finally, the BERTIN Society in 1959 proposed the false wing system. The events and abandonment of this program did not make it possible to pursue this project. However, new techniques of dilution, which have become available, seem to indicate that considerable improvements can be made.

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DISCUSSION

It seems that development work on lifting concepts using dilution systems originated in Europe.

First of all, in Germany there was the ARADO 232 aircraft in 1943 in which there was a suction-blower system for the boundary layer supplied by a high pressure vapor aspirator.

After that, the ONERA (National Office of Aeronautical Research) studied a compact suction-blower system starting with its inception in 1945 in France. The original configuration was supplied by compressed air taken by bleeding

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*Numbers in the margin indicate pagination in the original foreign text.

(1) Sté Bertin et Cie - 78 - Plaisir, France

the compressor of a turbojet. This was also the first time this method was used. Figure 1 shows the two principles of application of aspirators to the suction-blower problem. Note the description in Figure 2. In September, 1948, at the International Congress of Applied Mechanics in London, M. Poisson Quinton presented results obtained with this two-flap suction-blower wing. The results were presented by means of a dimensionless coefficient, $C\mu$, which is representative of the momentum expended during operation.

This arrangement was studied on a model of the size of the aircraft SO 6020, and then was applied to the prototype aircraft Bréguet Vultur.

Figure 3 shows the aircraft "Vultur" and a transverse section of the system installed at the rear of the wing.

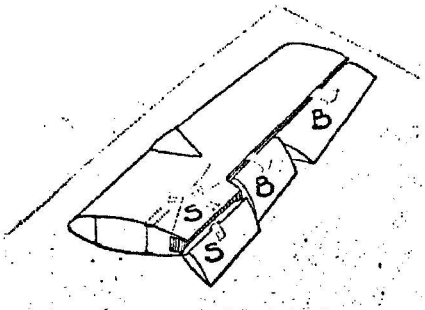
In 1959, the BERTIN Company proposed a wing-aspirator system, the principle of which is presented in Figure 4.

The channel which is formed between the two movable flaps, the deflections of which are variable, is adapted to the flight phase under consideration. In the deployed position, it is realized by the mixer-diffuser of the aspirator. The injector itself is movable so that the jet motor can be oriented in an appropriate way.

In the normal position during cruising flight, the flaps close the wing profile. However, a slit can be located along the trailing edge along which the motor propulsion gases can escape. This arrangement with a truncated profile with suction is favorable as far as drag is concerned.

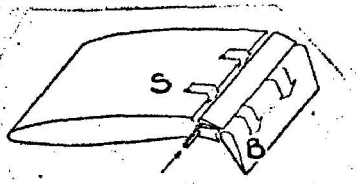
This arrangement constitutes an aspirator designed to increase the thrust with blowing along the trailing edge. This increase is greater than the momentum of the jet motor. The suction at the profile break has a sink effect which increases the hypercirculation around the profile.

COMBINED SUCTION AND BLOWING WITH EJECTOR SYSTEMS for boundary-layer control.



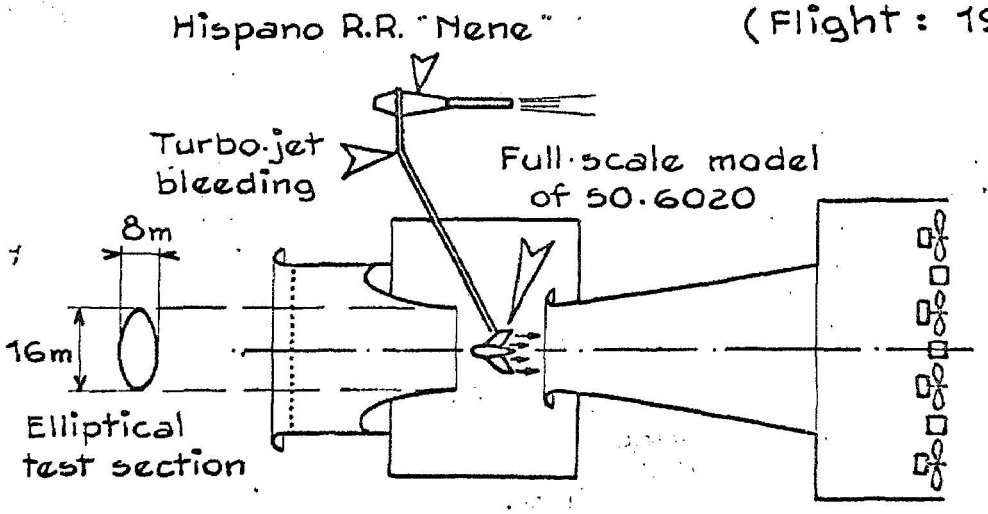
ARADO METHOD
(Wagner - 1943)
Applications :

* ARADO 232
(Walter chemical ejector).
* CESSNA 309.
* CHASE 123 D.
(Aspin turbojet)



ONERA METHOD
(1947)
Patent ONERA/SNCASO
1952
Applications :

* 50.6020 (1949).
* BREGUET "VULTUR"
(Flight : 1956).



French Republic

Ministry
of Industry and Commerce
Industrial Property
Service

INVENTION PATENT

Gr. 6. — Cl. 4. No. 969.264

Perfections in combined suction and blowing configurations for a wing profile using an induction aspirator (invention: Philippe Poisson-Quinton.)

NATIONAL SOCIETY OF AERONAUTICAL CONSTRUCTION OF THE SOUTHWEST AND NATIONAL OFFICE OF RESEARCH AND STUDY IN AERONAUTICS in France (Seine).

Requested July 17, 1948 at 10:40 AM in Paris.
Delivered May 17, 1950. — Published December 18, 1950.

(6 lines illegible)

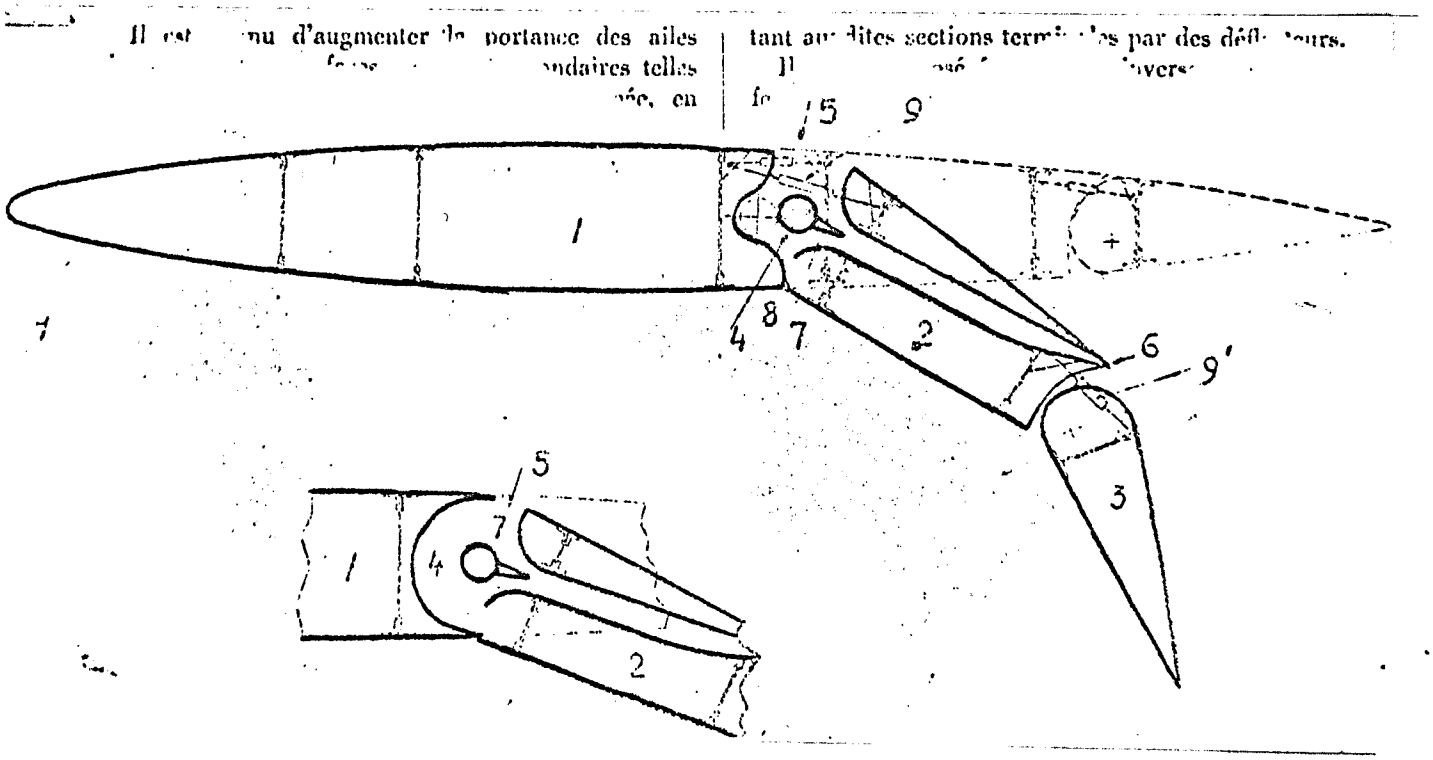


Figure 1.

INVENTION PATENT

Gr. 6. — Cl. 4. No. 952.926

Combined suction and blowing arrangement for a wing profile using an induction aspirator (invention: Philippe Poisson-Quinton).

NATIONAL STUDY AND RESEARCH OFFICE IN AERONAUTICS residing in France (Seine).

Ordered July 31, 1947 at 10:40 AM in Paris
Delivered May 16, 1949. — Published November 28, 1949.

[Invention patent which was delivered according to Article 11, § 7, of the law of July 5, 1844 modified by the law of April 7, 1902.]

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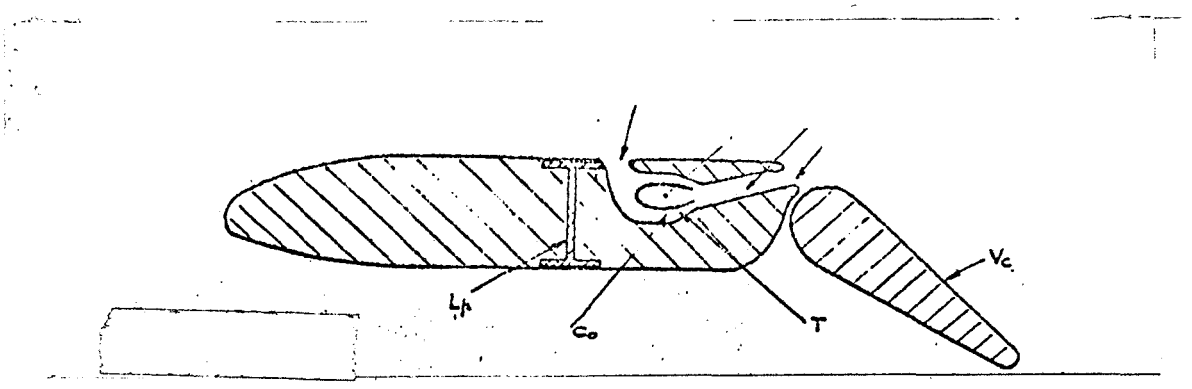
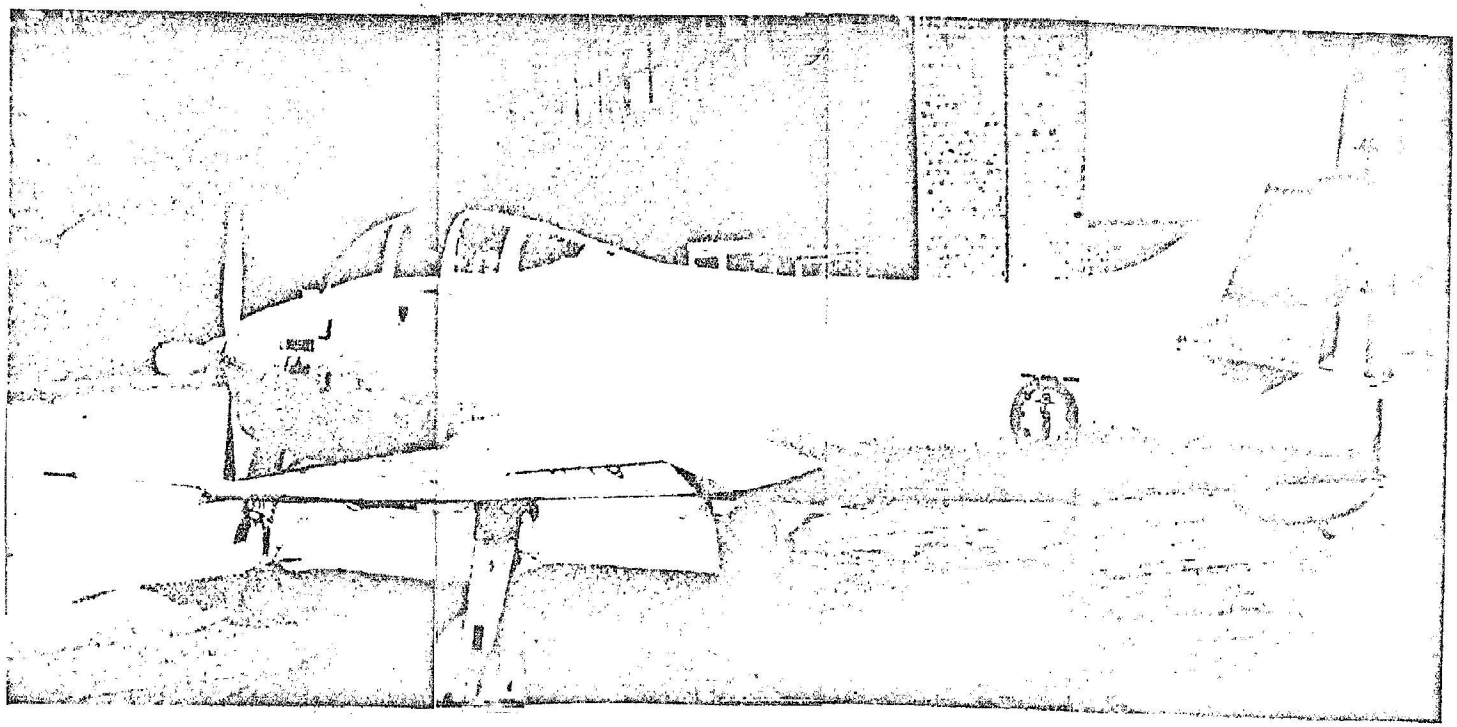
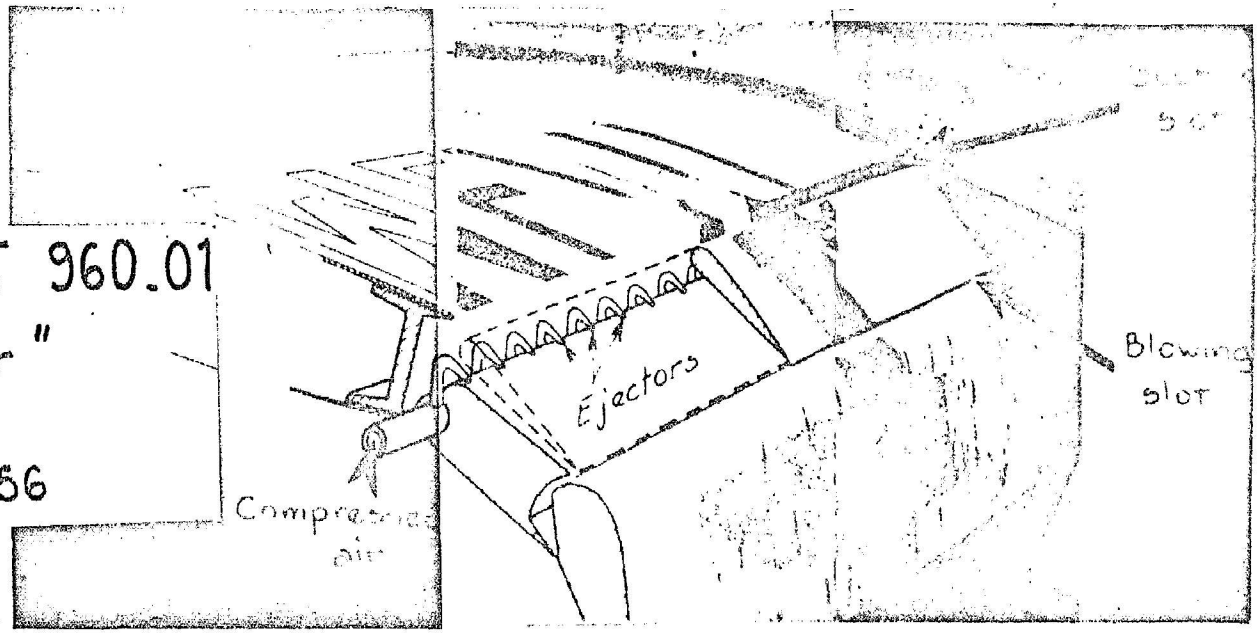


Figure 2.





BREGUET 960.01
"Vultur"

April 1956

French Republic

Ministry
of Industry and Commerce
Industrial Property
Service

INVENTION PATENT

P.V. No. 793.209 No. 1.233.014

International Classification: B24c

Perfections in aspirators for the lift of aerodynes.

SOCIETE BERTIN ET C^ie located in France (Seine).

Ordered April 24, 1959, at 7 PM by mail.
Delivered May 2, 1960. — Published October 12, 1960.

(Invention patent which has been delivered in accordance with Article 11, § 7 of the law of July 5, 1844 modified by the law of April 7, 1902.)

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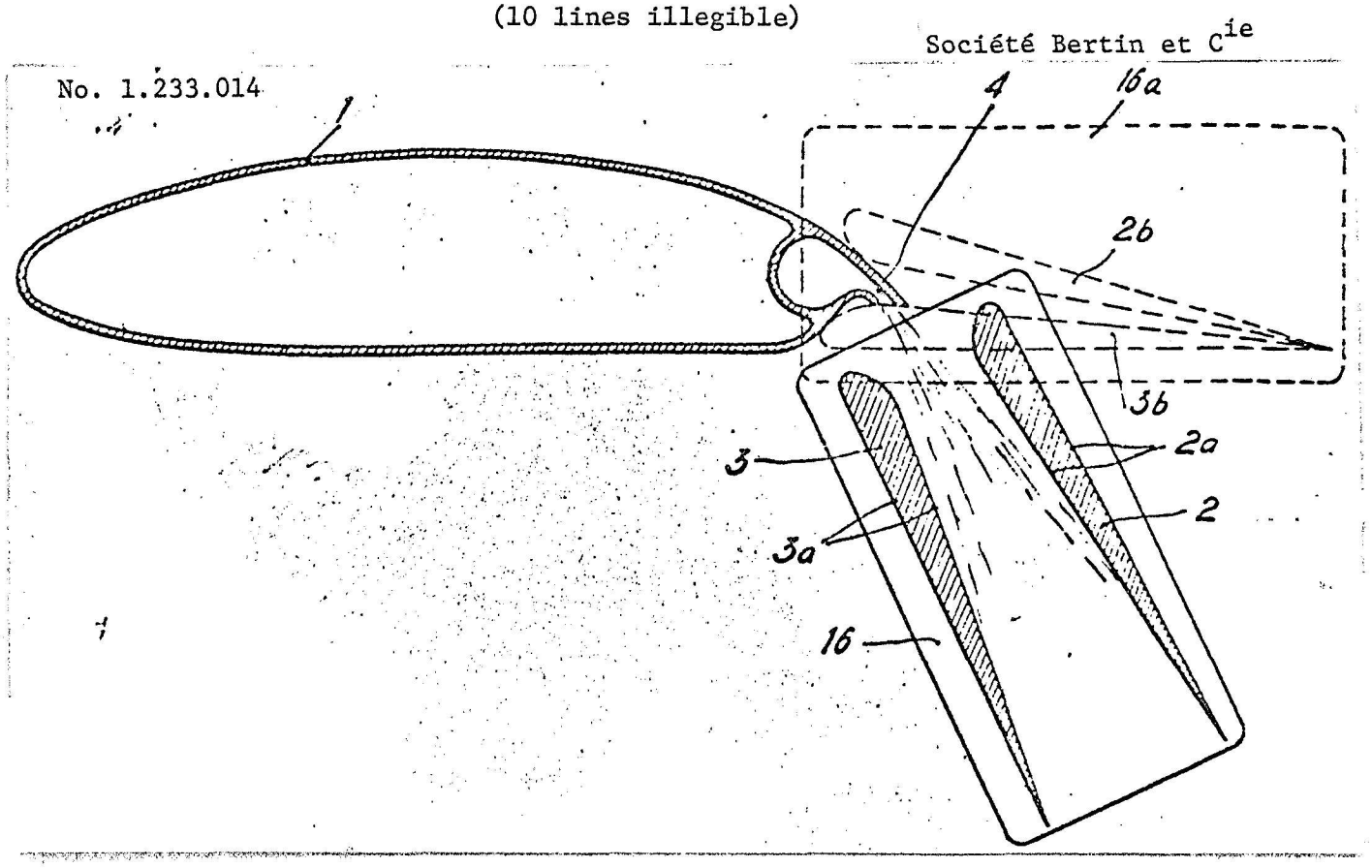

Figure 1.

TWO-DIM TESTS OF BERTIN T.E. EJECTOR in the S_1 Cannes/ONERA wind-tunnel (october 1959)

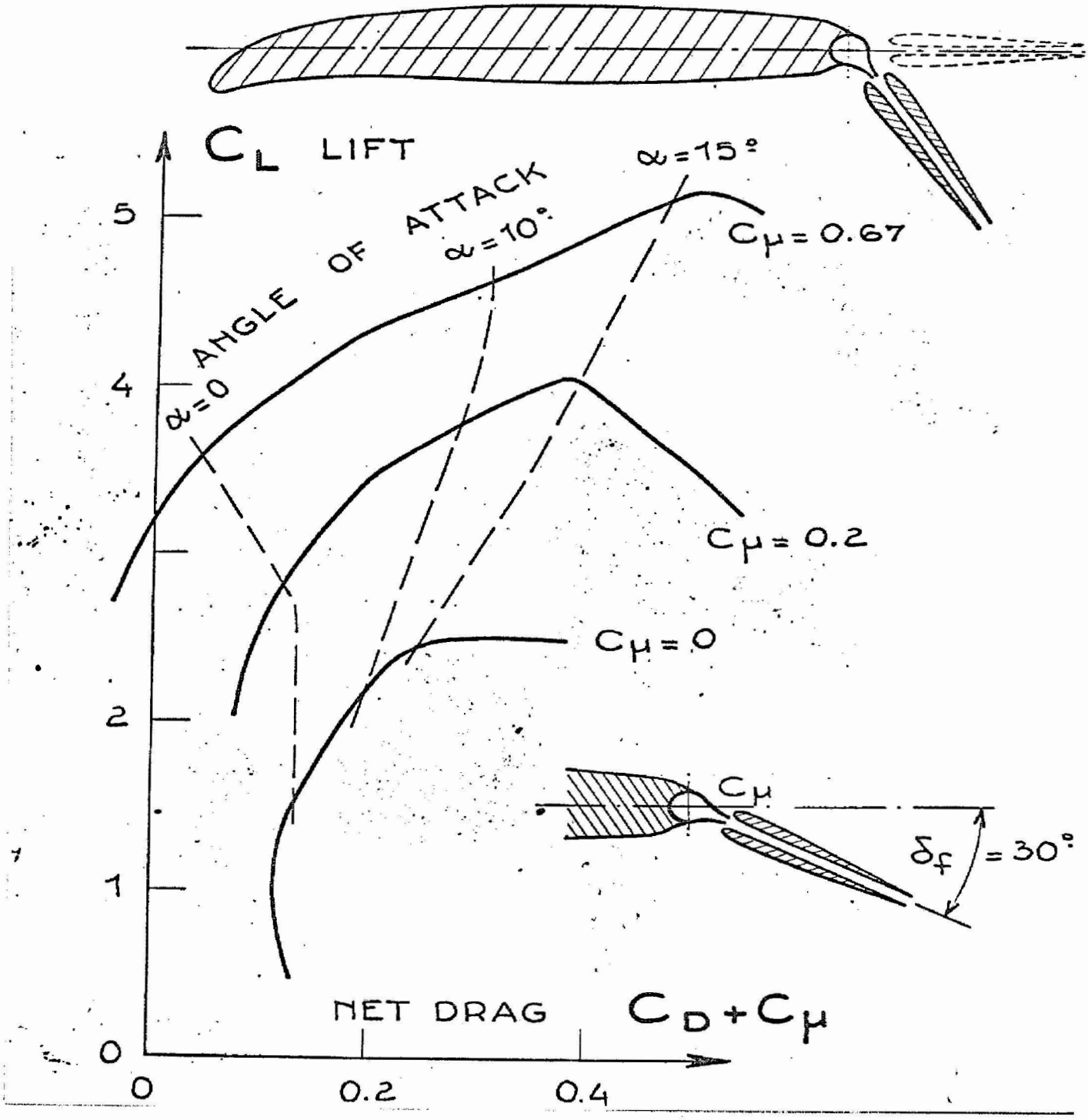

Figure 5 shows results obtained on models tested in 1959 at the Cannes Wind Tunnel of the ONERA.

The deflection of the flap pairs is $\alpha = 30°$. For higher deflection angles, the lift continues to increase.

These results made it possible to establish STOL aircraft projects, which were quite interesting already in 1959-1960.

Unfortunately, at the beginning of the 60's, the technical objective of a short takeoff was displaced by official preference for vertical takeoff. That is why this project was abandoned.

Obviously, problems of channeling the gas remained which led to the use of a high blowing pressure. It also limited the blowing yield. Nevertheless, thanks to dilution technology developed since then, we can look forward to considerable progress in the new development of this concept.

President of Science : Professor O. Lutz

AGARD

Propulsion and Energetics Panel

38th meeting

"Inlets and Nozzles for

Aerospace Engines"

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